

[Home](#) > [Resources](#) > [Classroom Practice](#) > [Curriculum](#)

Discourse Time! Developing Argumentative Literacy in the Math Classroom

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Mike Schmoker, author of *Results Now*, articulates that “generous amounts of reading, writing, and argument are all essential to the development of truly literate and educated students.” Moving this perspective of literacy to the world of mathematics, we may define a numerically literate person as someone who is able to read, write, and argue with numbers, or more important, mathematical concepts and ideas.

Since the start of my career as a math educator, I’ve been committed to the idea that reading and writing in the math classroom are essential. Cross-content literacy efforts, which are school-wide practices in many cases, have been ingrained in my beliefs around supporting student success. However, such efforts, though meaningful and valuable, have failed to consider the concept of argumentative literacy; the idea that students must be able to share ideas, listen to alternative perspectives, develop counter-arguments and transform their own thinking as well as those around them. Reading and writing comprise two pieces of the literacy puzzle; without argumentative literacy, a person may find him or herself to be illiterate. As Gerald Graff states “Argument literacy is central to being educated. It grants access to forms of intellectual capital that have a lot of power in the world.”

The purpose of the following text is to describe Discourse Time (D.T.), a teaching practice that aims to integrate argumentative literacy, the third piece of the literacy puzzle, into our math learning environments. Snapshots from a tenth grade classroom at Skyview Academy High School in Thornton, Colorado will be used to paint a vivid picture of what D.T. looks and feels like in addition to the way it impacts student learning.

Discourse Time!

“We can’t argue math, Mr. Singer. It’s true, it’s specific,” insisted Taylor. “Are you sure? I really think we can.” “How can you? There’s nothing to argue about. There’s no side to take,” she responded. “Are you positive about that? Do you really think we can’t argue mathematics?” Taylor and I continued to debate for a little while until I finally pleaded with her to give me a chance at proving her wrong. “Fair enough,” she said, “prove me wrong.” With our unresolved argument lingering, I introduced my class to the idea of mathematical discourse.

Having just visited an amazing humanities classroom a day earlier, I took some time to describe what I had seen to my students. “For a half an hour, six kids in the class ran the show. They completely owned the classroom. It was awesome. Mr. Munoz, their teacher, provided them with a few questions to guide their discussion, but other than that, the whole thing was student-centered. They were debating about what kind of person Christopher Columbus was and using all sorts of reference documents, his journals, pictures, history books, whatever else, all in attempts to support their positions. The cool thing was listening to students call each other out. Like, what evidence do you have to back that up? Prove it! You’re just talking – you’ve got no support! Anyway, it was really exciting to watch, and I want to make that learning environment a regular part of our class.”

“Aren’t you proving my point, Mr. Singer?” chimed in Taylor. “We argue and debate in social studies all the time. That subject’s set up for that kind of thing.” “So is math!” Seizing what seemed like a teachable moment, I couldn’t help but share my strong opinion on the matter. “Do you really think the rules we use today, the math that we take for granted, was accepted right away? Do you think that other mathematicians just looked over an idea, said okay, sounds good to me, and accepted it as fact? Absolutely not! They argued and debated; they pounded their fists on tables in an effort to emphasize their points. That’s what I want you guys to do...pound your fists on tables!”

"You want us to pound our fists on tables?" questioned Omar in a confused manner. "Yes! I want you to get excited about math, I want to give you a chance to really experience what it's like to be mathematicians with one another. If that means pounding your fists on tables, then so be it." And thus the birth of Discourse Time, a once a week ritual that finally invokes the spirit of a quote I've had hanging on my wall for over two years, "You have no right to no opinion."

How does Discourse Time Work?

"Unlike casual conversation...discourse requires a combination of both reflection and action. That is, during the exchange of ideas, participants attempt both to gain insight into the conceptions of others and to influence them" write Azita Manouchehri and Dennis St. John in *Mathematics Teacher*. That's what D.T. is all about: students sharing their ideas, listening to others, and transforming the way they think about mathematics.

CES cofounder Deborah Meier recognizes this belief to its fullest. "Intellectual argument was a daily feature of life at her school, Central Park East Secondary School. For Meier, argument and discussion provide perhaps the best opportunity for kids to become critical thinkers, for us to help them see the power of their ideas," writes Schmoker of her work in *Results Now*. In a democratic school grounded in the ten Common Principles, it's essential for our math classrooms to encourage and support students in sharing their voice. That's why discourse is so important. Now here's how to make it happen.

Where Should Discourse Happen?

The ideal physical environment for D.T. is a large table around which five to seven students can sit, a dry erase board next to the table for those engaged to present ideas, and a circle of chairs on the outside for the remaining students and teacher to observe.

What Do the Students Directly Involved in the Discourse Do?

The students directly involved in the discourse collaboratively attempt to solve a problem. This isn't the sort of problem that has a clear right or wrong answer, nor is it the kind of problem that students could tackle alone at their desks. It's the kind of problem that forces students to use their minds well. This is the kind of problem that lies directly inside of psychologist Lev Vygotsky's zone of proximal development. As described by Jeff Wilhelm, this learning "zone" is defined as "anything that the child can learn with the assistance and support of a teacher, peers, and the instructional environment." The beauty of D.T. is that it relies heavily on the "peers and instructional environment" components of Vygotsky's zone and far less on the "support of a teacher" component. Our CES principle of "teacher as coach, student as worker" is emphasized in Discourse Time as the ownership of learning is placed heavily on the students while the teacher becomes a facilitator of thinking.

In his text *Comprehending Math*, Arthur Hyde makes a succinct and highly enlightening point. "What do I do?" is the right question for kids to ask when attacking a challenging problem in mathematics. However, they've been asking the teacher when all along, they should be asking themselves. D.T. puts this research into practice in the math classroom.

The problem selected for D.T. should be directly related to the essential learning taking place in class. The experience should act as another opportunity for students to engage in developing their understanding of the formal learner outcomes that have been established. This provides the teacher with another opportunity for formative assessment as she may examine what her students know and are able to do within the essential learning being explored in class.

How Do the Students Sitting at the Table Know What to Do?

Creating a set of expectations that the entire class is both comfortable and familiar with is crucial to the success of Discourse Time. Students participating in D.T. must feel safe in order to take mathematical risks. A scoring system, such as the one outlined below, is a great way of emphasizing what the expectations are and what is truly valued during D.T. Collaboratively creating the scoring system with students in advance of getting involved in a D.T. gets the whole class thinking and discussing what is valued in this activity. Here's how it might look:

- States an opinion relevant to the problem (1 point)

- Draws another person into the discussion (1 point)
- Makes a connection – doesn't have to be math based (1 point)
- Supports an opinion with factual evidence (1 point)
- Asks a question that moves the discussion - pushes the group's thinking (2 points)
- Proves someone else's opinion with evidence (2 points)
- Takes away from the value of D.T. (- 1 point)

While "right and wrong" answers have nothing to do with the scoring system; providing evidence to support your position is a "2-pointer." The scoring system may be revised to meet the needs of any classroom, but should emphasize the core values of the class it is serving. In the end, teachers should examine the agreed-upon scoring system through the lens of the following question, what kind of message does this send to the participants?

What Do the Students Sitting Outside Do?

The students outside of the D.T. can have many different jobs. In the D.T. currently going on in my classroom, there are two roles. The first is to act as a scorer for a student in the middle. If six students are participating in D.T., then there are six scorers sitting on the outside, each assigned to a D.T. participant. Having the scorers sit directly across from the student they're evaluating helps ensure that they may not only hear what students are saying, but also see what students are doing. Simple tally marks documenting when each item on the score sheet is being addressed makes the process fairly easy to follow and also promotes students on the outside to be active observers.

A second job for the remaining outside observers may be to record a double entry journal. One heading focuses on the "I notice..." while the other emphasizes the "I wonder..." For example, a student may write "I notice that Monique doesn't willingly share her ideas" or "I notice that students are easily persuaded to believe Osvaldo's opinions." On the "I wonder" side, you may hear a student state "I wonder why Maria writes so much, but shares so little" or "I wonder who's actually right." These observational notes in the form of a double entry journal do a great job of providing non-participants with an active role. In fact, their notes act as a foundation for the class-wide debrief that may take place directly following the D.T.

What Does the Teacher Do?

As stated earlier, D.T. is a great opportunity for the teacher to check in with her students. The teacher may take notes on what she sees and hears the students doing. These notes may then serve as a formative assessment, guiding her upcoming instructional decisions. They may also act as part of the students' bodies of evidence as they work to prove their learning of the essentials. The notes documented by the teacher may be copied and distributed to the D.T. participants. Examining the teacher generated observation notes, students may highlight the statements they made and use the document as part of their portfolio as a piece of physical evidence toward their level of learning.

Why Do We Need Discourse Time?

Although many classrooms currently experience some form of mathematical discourse in an informal fashion we must take such practice to the next level. The majority of discourse found in our classrooms rarely forces students to take the role of mathematician as they engage in what Ellin Keene defines in *Dimensions of Understanding* as "rigorous discourse." D.T. is merely one way to create an authentic arena for valuable mathematical argument to take place. In addition, setting aside time in our class to address this need sends a message to our students that sharing, defending, and transforming mathematical ideas is an extremely valuable way to develop argumentative literacy; the third component of literacy.

What Does D.T. Actually Look Like When We Do It?

What follows is an example of Discourse Time. The context of the work is taken from a heterogeneous, ninth-grade Algebra/Geometry I course. The sample D.T. includes most elements of the process; due to space constraints, the teacher notes, which are made on a worksheet containing the seven areas in which students score points (listed above) has been omitted. The following example of Discourse Time contains:

- The essential learning being explored in class at the time of D.T.
- The problem used in D.T.

- Student double entry journal notes (I notice... I wonder...)
- A debrief of the experience

Discourse Time Sample 1: The Boat Race

The Essential Learning: Students will use proportional thinking to analyze and solve real world problems within geometric and algebraic contexts.

The Problem: In a two-boat sailing race, one boat, *Windsprite*, rounds the final buoy and sails straight for the finish line at 12.0 knots. Exactly 4 minutes after *Windsprite* rounds the final buoy, the other boat, Porpoise, reaches that point and heads for the finish line at 12.7 knots. *Windsprite* reaches the finish line 49 minutes after rounding the last buoy. Who wins the race? Why?

Student Double Entry Journal Notes

I notice...

That most of them are underlining important things

That some aren't talking

That Manuel started to talk and 2 other people started to talk about the same problem

That Singer stepped in to help them with their problem

Salvador made another connection

Jessica did a math connection

Manuel made a math connection

I wonder...

Why Salvador and Monique aren't talking

What the actual answer is

Who knows what the answer is and who is confused

The Debrief: What made this D.T. challenging for students was their lack of contextual knowledge. Boating is not part of their general schema; as a result they had to develop their background knowledge in order to engage in the work. Recognizing a need to find information prior to jumping into problem solving is a great asset for a mathematician. Moreover, resourcefulness – using resources to accommodate the recognized need – is a skill that all great thinkers possess.

The connections made by participants, both to their work in science class with unit conversions and their own life experiences, were amazing to hear. Those connections bring the problem to life for those students and take it beyond the walls of the isolated math classroom. In addition, the connections also recognized by Daniel in the double entry journal notes let me know that he too witnessed their value. Beyond Daniel's observation about connections, he also recorded "that [teacher] Singer stepped in to help with the problem." During our class debrief, when Daniel mentioned this "I notice" comment to the class, I asked if my involvement was unnecessary or overbearing. The general consensus from the participants was that my involvement pushed the thinking of the participants and never provided solutions or answers. As a result of Daniel's observation, I was able to assess my own involvement in D.T. and its importance or lack thereof to the group effort.

"You can't divide something by a number if it's not given," stated Manuel during the D.T. In response, Jessica rebutted, "Yes you can - you can divide by a variable like x ." Her counter-argument to Manuel's strikes at the heart of algebra. We can work with information even when numbers are missing. That simple statement informs me a great deal about Jessica's internalized understanding of the purpose of algebra.

Final Thoughts about Discourse Time

Experimenting in the classroom with an activity like Discourse Time involves a great deal of variability of

several factors: the selection of a problem, the contributions of the students participating, the observational notes being taken, the scorer's accuracy, and the teacher's involvement. However, when D.T. goes well – and I can assure you from personal experience that that's not always the case – the learning that the community can take away is invaluable. Students gain:

- Deeper conceptual knowledge of mathematical ideas
- The ability to learn and apply new information
- Increased resourcefulness
- The experience of challenging each other's thinking
- The skill of determining what a question's really asking
- The experience of listening to someone else's opinion and synthesizing it with your own
- The ability to collaborate effectively
- The benefit of engaging in mathematical conversations

Such an experience allows students to explore what it's truly like to be a mathematician. Encapsulating the goal of developing creative, critical thinkers and problem solvers, Discourse Time is an essential component of an Essential school math classroom. As CES founder Ted Sizer writes in *Horace's Compromise*, "Understanding is more stimulated than learned. It grows from questioning one's self or from being questioned by others...Questioning is a far more difficult form of pedagogy for teachers than are coaching and telling, because it is the least predictable." Discourse Time is certainly not a predictable teaching practice. However, as responsive and progressive teachers whose efforts lie in preparing our students for the 21st century, we must embrace the value of such a practice. Dr. Sizer certainly has as he continues in *Horace's Compromise*. "Education's job today is less in purveying information than in helping people to use it – that is, to exercise their minds." Discourse Time is far less concerned with "purveying information" and much more interested in helping students to "use their minds well."

Skyview Academy High School opened in 2005 as a new small Essential school focused on discussion-based, topic-directed learning for all of the core content areas, project-based learning, and advancement and graduation by portfolios and exhibitions. Currently serving 300 students in grades nine through eleven, Skyview Academy's first senior class will graduate in 2008.

Teaching Note: The purpose of the scoring system is not to work for or against a student's grade. Rather, the goal of the scoring is to emphasize the values of the classroom in a highlighted arena, which in this instance takes the form of Discourse Time. Posting high scores from each class excites students about their contributions to D.T. although some still demand a grade linking their contributions to their overall grade in the course. For help with dealing with those students having a strong desire for their contributions to be linked directly to a grade, please read below in the "What does the teacher do?" section.

"Creating a learning community that supports and encourages students' authentic engagement in the construction of mathematical knowledge depends primarily on the teacher's own efforts and instructional behaviors...If one hopes for students to develop the mathematical and social dispositions to act as a community of learners, then teachers must both support and model those ways of thinking and acting." - Azita Manouchehri and Dennis St. John, *Mathematics Teacher*, April 2006

"All students need opportunities to talk about what they're learning: to test their ideas, reveal their assumptions, talk through the places where new knowledge clashes with ingrained belief" - Mike Rose, quoted in *Results Now*.

Related Resource

Discourse Time in mathematics bears a clear correspondence to Socratic seminars, a discussion format commonly used in many Essential schools. For more on how Essential schools incorporate Socratic seminars to teach for understanding, read "Less is More: The Secret of Being Essential" in Horace Volume 11, Issue 2, November 1994, www.essentialschools.org/cs/resources/view/ces_res/88

For more on the restructuring of the Mapleton School District of which Skyview Academy High School is a part, read "The Stars Aligned: A Study of System Change in Colorado's Mapleton Public Schools," in Horace Volume 21, Issue 3, Summer 2005, www.essentialschools.org/cs/resources/view/ces_res/370

After graduating from the University of Hartford in 2003, David Singer moved to Denver to teach at Skyview High School, a large comprehensive high school. In 2005, he joined the design and implementation team for the creation of Skyview Academy High School, a small CES school in Thornton, Colorado and has taught there since the school's opening.

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